

JOURNAL
OF THE
New York Entomological Society.

VOL. XXIII.

DECEMBER, 1915.

No. 4.

NOTES ON THE IMMATURE STAGES OF SOME NEW
YORK TRICHOPTERA.*

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The larvæ of the four species of Trichoptera whose immature stages are herein described were captured in waters in the vicinity of Ithaca, New York. The adults which emerged in captivity, except *Neuronia pardalis*, were kindly determined by Mr. Nathan Banks.

Neuronia pardalis Walker.

Larval Habits.—The larvæ were found in two small spring-fed streams in the McLean swamp, about eighteen miles north of Ithaca. These streams are overhung with a dense thicket of alders and their bottoms are littered with fallen leaves, but are almost free from living vegetation.

Few specimens were found and little effort was made to draw conclusions concerning the food and habits of the species. Such observations as were made, however, indicate that the habits are the same as those of the well-known *Neuronia concatenata*. The larva of this species crawls about over the bottom and among submerged vegetation feeding on leaves living and dead. In preparing to pupate it attaches its case tightly in some secluded crevice and spins a silken mesh across each end of the case. Frequently fragments of grass or other bits of vegetable matter are cemented around the forward end of the case.

* Contribution from the Limnological Laboratory of the Department of Entomology in Cornell University.

Abdomen.—In life dark green with a distinct reddish tinge especially on the dorsal side; gills pale reddish; each lateral hump is tipped with a circular spot of small spines, near the center of the spot there is a seta; the dorsal hump ends in a pointed finger-like process; the lateral fringe commences at the middle of the third segment and extends to the caudal margin of the eighth segment, where it ends on a backward projecting lobe, the fringe is weak and composed of very fine hairs; the arrangement of gills is diagrammatically shown in pl. 16, fig. 13, the gills of the median line possess hairs, continuations of the lateral fringe; the ninth segment, as seen from above, projects backward as a prominent lobe which bears a chitinous plate and is armed on its caudal margin with four well-developed setæ and several of smaller size; on the fleshy projection above each drag-hook there are three large and several small setæ; the drag-hooks bear one large and apparently three small hooks on the dorsal side, pl. 15, fig. 2, illustrates a drag-hook with only the largest of its three teeth showing, the others being hidden behind this one.

Pupa.—Description made from a cast skin. The mouthparts are weakly chitinized, the labrum is rectangular with rounded corners, about one and a half times as long as wide; the mandibles are about half the length of the labrum and are almost as broad as long, a projection on the outer side bears two prominent setæ on its tip; the lateral fringe commences on the cephalic margin of the fifth abdominal segment and loops under the caudal margin of the eighth segment; a pair of sucker-like disks occur at the caudal margin of the last abdominal segment above. Each disk has a single seta on its outer margin and a group of three large setæ beneath its cephalic margin; the first abdominal segment has a striate appearance above and is bordered behind by a mark, as in pl. 16, fig. 5; the arrangement of teeth on the dorsal plates is illustrated in pl. 16, fig. 5.

The Case.—Length 30–40 mm.; breadth about 5 mm. In form it is a slightly curved cylinder, tapering a very little toward the rear end. It is built of quadrilateral sections of leaves arranged in a series of three to five circles. The inside is lined with a thin layer of silk. The case is light in weight and is easily dragged about by its active occupant who, on very slight provocation, will quit the case entirely.

We are unable to give characters for separating the case of this species from those of other species of the genus.

Limnephilus combinatus Wlk.

Larval Habitat.—We have found the larvæ of this species in only two localities; Michigan Hollow, about seven miles south of Ithaca, and McLean, about eighteen miles to the north. At Michigan Hollow they inhabit the slowly flowing spring-fed stream which flows out of an upland swamp. This stream contains little or no vegetation, except the thick grass along its border. The larvæ occur most abundantly where the stream flows through an open meadow below the swamp, but are also found in the swamp itself, where alders and hemlocks form a dense thicket to the very borders of the stream. Their habitat at McLean is also a spring-fed stream with slow current, but flowing through an open deciduous forest. This stream contains grass and other vegetation along its edge and its bottom is strewn with fallen leaves. Both streams are less than five feet across; the one at Michigan Hollow is two or three feet deep while the depth of the one at McLean does not exceed a few inches.

Larva Habits.—During their early life the larvæ frequent the grass and sedges which fringe the edge of the stream, as the time for pupation draws near the larvæ wander from the edges of the stream, where marsh grass abounds to the middle of the stream where living vegetation is entirely absent. Here they attach the front end of the case firmly to some solid support, as a stick or stone. Often many of these pupæ are found congregated on a single small stick, while on the other sticks in the region they are entirely absent.

Food of the Larvæ.—The food consists, apparently, entirely of vegetable matter. Several stomachs from specimens taken at different periods of late spring and early summer were examined. These contained only the tissue of higher plants, but it seems probable that during the cold weather, when diatoms abound, that these may compose a considerable portion of the diet of this species.

Period of Emerging.—This species is one of a very few Trichoptera known to us which emerge during a long period. On May 22 there were pupæ in the stream but no empty cases were found. On June 7 the first specimens in captivity emerged, but at that time there were many empty cases in the stream. From June 7 until July 22, when the last captive specimen emerged, their transformation in the cages was of almost daily occurrence. On the latter date, however, there were still many pupæ in the stream, and also a few prepupæ.

From this data we may assume that the species is on the wing from early June until the middle of August.

DESCRIPTION OF LARVA, PUPA AND CASE.

Larva.—Length when mature 17–20 mm.; breadth about 4.5 mm.

The Head.—The dorsal markings are shown in pl. 15, fig. 6; on the sides the head is light brown mottled with dark brown or black in the region behind the eye, as is partly shown in the figure; the venter is light brown in front, becoming darker toward the hind margin. The labrum is shown in pl. 16, fig. 14; the frons in pl. 16, fig. 22, and the labium and maxillæ, in part, in pl. 16, fig. 19.

The Thorax.—The dorsal markings and distribution of the principal setigerous punctures are shown in pl. 15, fig. 6; on the sides, above each coxa, there is a dark chitinous plate bearing a group of setæ near its front margin, the venter is uniform in color. The “horn” on the ventral side of the prothorax is slender and evenly curved forward. The legs are dark brown, margined and mottled with dark brown and black.

The Abdomen.—The first segment is darker in color than the succeeding segments, it is armed with a few setæ in the region of the humps and on its ventral surface; segments two to seven bear a few minute setæ; segment eight is bordered along its hind dorsal region by a dark area which bears a row of about six setæ; segment nine curves sharply downward and is darker in color than segments two to eight, it bears a dorsal chitinous plate which is armed with four large, and several smaller setæ; segment ten is also dark in color and bears several strong setæ in the region of the drag-hooks; on the under side of each segment two to seven there is a narrow hairlike mark, oval in shape; the lateral fringe is short and black. The distribution and number of gills on the left side of the body are indicated diagrammatically in pl. 16, fig. 15.

Rupa.—Length 20–22 mm.; breadth about 5 mm. The antennæ extend back to about the hind margin of the seventh segment; on the dorsal surface of the head, between the antennæ, there is a pair of strong setæ and on the front surface, midway between the dorsal setæ and the labrum, there is a pair of similar setæ; each lobe of the labrum bears a group of stout setæ which are curved, but not hooked, at their tips. On the second and third pairs of legs the

swimming hairs are well developed. The lateral fringe is thick and black; the projections of the last segment are much as in *L. indivisus*, pl. 16, fig. 17. The dorsal surface of the first abdominal segment and the chitinous plates (the latter subject to variation in the number of teeth) are shown (left side only) in pl. 16, fig. 20.

The Case.—Length 20–25 mm.; the breadth varies greatly according to the material used in construction. The young larvæ, before they leave the grass on the stream's edge, make a case of the cross-stick type common in this genus. When, as the time for pupation draws near, they migrate away from the grassy area, their cases take on an entirely different appearance being constructed of shells, or small chunks of bark, or seeds, from the bottom. In the meadow area at Michigan Hollow the building material used, after their migration from the shore line, consisted almost entirely of the shells of water snails,—*Planorbis* and *Sphaerium*, for the most part,—and of oval seeds. Pl. 15, fig. 14, shows a case from this area. Higher up in the same stream, where the waters are overhung with thickets, the larvæ use chunks of bark in the construction of their cases, pl. 15, fig. 10. Different combinations of these materials are frequently found and sometimes cases are encountered in which the front part is made of shells or chunks, while the hind part retains the cross-stick construction used in its previous environment.

Limnephilus indivisus Wlk.

Larval Habitat.—Upland pools or ponds which are rich in decaying vegetation and are subject to desiccation during the middle or latter part of summer.

In waters which it inhabits this species is found in extraordinary numbers, its cases almost covering the bottom of the pond during its late larval period.

Larval Habits.—During the period when water covers their habitat the larvæ can be found clumsily drawing their bulky cases over the bottom of the pond, or climbing over the vegetation. Their activity, apparently, does not cease during the winter months.

Food of the Larvæ.—The larvæ apparently eat vegetable matter, living or dead, with little discrimination for species or condition of preservation. They may readily be seen browsing on dead and decaying cat-tail or sedge, or on living plant tissue, or scraping loose

fibers from submerged sticks. The stomachs examined contained particles of higher plant tissue in all stages of preservation, as well as many algæ, but decaying tissue was always in greatest abundance. The dominance of decaying tissue in the stomachs may be explained by a glance at their habitat during spring, before the period of pupation. At this time the pools are full of dead and decaying cat-tails and sedges; living plants are relatively rare. The algæ are apparently swallowed accidentally with the larger plants over which, in these pools, they form a thick scum.

Pupil Habits.—Early in May, close examination of a pond where the larvæ had been found in great abundance, covering the bottom with an almost unbroken mass of moving cases, at first revealed not one inhabited larval or pupal case. They were not on the bottom, nor were they clinging to the vegetation, as is the habit of some species of the genus when pupating, nor were they under sticks or logs, nor in crevices. At last they were found deep down among the fibrous roots of sedge tussocks. Here they occurred in such numbers that they could be brought out by the handfull from every tussock. Well hidden as they were, their hiding place had been found by the muskrats of the region. Stumps and floating logs were piled by the rats with broken pupal cases from which the contents had been removed. Muskrat feces taken from these locations and disintegrated in water revealed enough chitinous fragments to indicate that the caddis pupæ were an important article of diet at this season.

On emerging the pupæ come to the surface and swim about, apparently blindly, until they encounter some suitable support projecting above the water where, climbing a few inches above the surface, they transform. The greatest number of adults were on the wing during the middle of May. At this time swarms of them clung to every nearby bush or, as dusk changed to darkness, flew over the pond.

DESCRIPTION OF LARVÆ, PUPA AND CASE.

Larva.—Length when mature 18–21 mm., breadth 3.5–4.5 mm. The color of the heavily chitinized parts is brown; the abdomen and weakly chitinized parts are white in young specimens, and rusty brown in individuals that are almost ready to pupate. The rust-like appearance of the weakly chitinized parts of this larva is caused by a coating which can, with difficulty, be removed, leaving the skin

white and revealing a sparse armature of very minute spines. The distribution of this rust-like coating is nearly uniform in different individuals and it seems apparent that it is a secretion from the skin.

Head.—Marked above as in pl. 15, fig. 8; the sides are light brown without sharply defined marks but, on caudal portion, bearing many small inconspicuous spots where the muscles are attached; the ventral side is uniformly light brown, except the extreme caudal portion which is crossed by the area of dark spots extending downward from the sides; the antennæ are jet black, except an area at the base, which is brown; the labrum, pl. 16, fig. 10, is light brown bordered with dark brown; the mandibles are jet black, truncate, with fine teeth and a rather sparse brush of light colored hairs on the edge of the groove; of these hairs the most cephalic are shorter and thicker.

Thorax.—The dorsal markings are shown in pl. 15, fig. 8. The prothorax bears minute forward-pointing spines on its cephalic dorsal margin; its setæ are long, some equal to the length of the segment; a raised, black, collar-like ridge extends from the base of the legs over the dorsum of the caudal margin of the segment, except at the median area, where it is broken; the ventral surface is white, except a brown mark which bears two darker marks near its caudal margin; and a small darker spot behind each leg; the fleshy horn is curved and well developed. The mesothorax is white beneath with four dark spots near the caudal margin. The metathorax is white on the under side with two broken dark marks.

Legs.—Brown with darker margin and armed with numerous long black setæ.

Abdomen.—The humps are well developed, the dorsal hump bears a pointed, finger-like process and the lateral humps are rounded; groups of setæ occur at the sides of the humps; about six large setæ and several small ones occur on the ventral surface of the first segment; other segments do not bear large setæ on their ventral surfaces; segments two to seven bear single small setæ on each side of the median line above; segment eight bears a row of about ten setæ across its ventral margin; segment nine has an oval chitinous plate on the dorsum which bears four large and many small setæ; each drag-hook has three small teeth at its base and is preceded by a chitinous plate bearing about ten setæ; a row of three large setæ occurs inside of each drag-hook and behind the chitinous plate; the lateral

fringe is black and well developed, it extends from near the cephalic margin of segment three to the caudal margin of segment eight; above the lateral fringe on each segment occur minute, brown, paired spine-like processes; the gills are well-developed, their number and distribution are shown diagrammatically in pl. 16, fig. 11. The weakly chitinized portions of the entire larva are thickly set with minute spines.

Pupa.—Length 13–17 mm., breadth 4–4.5 mm. In life the color of the thorax and appendages is brown, the abdomen is green and the lateral fringe is deep black. The antennæ extend back to about the caudal margin of the eighth segment they bear groups of short setæ on the dorsal sides of the second segments; each side of the labrum bears a group of about six long hooked setæ; a row of sharp, curved, forward pointing spines borders the caudal margin of the eye; the second and third pairs of legs have well developed swimming hairs and, in advanced pupæ, show the black spines of the adult conspicuously; the lateral fringe is well developed, commencing on the caudal margin of segment five and turning under the abdomen at the caudal margin of segment eight; the gills are well developed; the last segment bears a number of setæ and two backward pointing processes, pl. 16, fig. 17.

The Larval Case.—The length and breadth vary according to the material found in its environment. It is always bulky and is usually of the cross-stick type common in the genus. It may be made of bits of leaves or plant stems or, sometimes, of seeds. When seeds are used it does not show the tendency to cross the material. The cavity is cylindrical and is always lined from end to end with a sheet of silk.

The Pupal Case.—Differs from the larval case only in having the mesh of silk across its ends as illustrated in pl. 16, fig. 12.

Chilostigma difficilis Walk.

Larval Habitat.—The larvæ of this species have been found by us in a very limited area of a stream in the McLean swamp. The stream is a small one, hardly more than a foot in width and three or four inches in depth. It rises in a sphagnum bog and penetrates a dense thicket of alder for about a half mile, when it enters a larger stream. Through the alder thicket the waters are in deep shade,

and leaves and sticks litter the bottom. In this portion of the stream, so far as we can see, there are no differences of conditions within its waters. Yet this species, for the three years we have known it, has inhabited an area of the stream not more than a hundred yards in length. In this limited area it occurs in great numbers.

Larval Habits.—Until the middle of the summer is past these larvæ rest or crawl slowly about over the bottom of the stream. As the period for pupation approaches they congregate in great numbers on submerged sticks or roots. Often they occupy every available lodging space on a certain stick while other similar sticks of the neighborhood are left entirely free from their presence. Only the front ends of the cases are attached to the support, from which they project at all angles.

Food of the Larvæ.—Stomachs examined contained quantities of fragments of wood and leaves; nothing else.

Period of Emerging.—Specimens in captivity emerged October 6-13; but it is probable that under natural conditions they emerge throughout a longer period.

DESCRIPTION OF LARVA, PUPA AND CASE.

Larva.—Length 16-18 mm.; breadth 2.5-3 mm.

The Head.—The color is light brown, almost uniform, except the dark circles indicating the position of the attachment of muscles and a thick stipling of microscopic spots; the dorsal surface, especially the frons, pl. 16, fig. 7, bears numerous pointed, spear-like processes which are plainly evident in balsam mounts. The labrum, pl. 16, fig. 6, is brown with a darker mark behind the middle of its front margin, the innermost setæ on its front margin are short and blade-like, the outer setæ of the front margin are longer, but blade-like, other setæ of the labrum are indicated by circles in the accompanying drawing. The mandibles are black, with a line of dense yellow hair on the top edge of the groove.

The Thorax.—The prothorax is light brown with a slightly oblique black mark on each side above the coxa; the top surface has, in addition to numerous setæ of the ordinary type, many shorter, spear-shaped, forward pointing spines, not shown in the accompanying figures; these are most numerous along the front margin, where they project over the base of the head; the dorsal markings of the

meso- and meta-thorax are shown in pl. 15, fig. 5. The legs are light brown, margined and marked with black, pl. 15, fig. 3, shows a front leg.

The Abdomen.—The lateral fringe is short and weakly developed, it extends from the front margin of the third segment to the hind margin of the eighth segment. The distribution of gills is diagrammatically shown in pl. 16, fig. 9.

Pupa.—Length 10–11 mm.; breadth 2–2.5 mm. The antennæ extend back almost to the tip of the abdomen. Each side of the upper surface of the labrum bears a group of about five long, black, hooked setæ. The mandible is shown in pl. 16, fig. 18. The lateral fringe begins near the hind margin of segment five and curves under the hind margin of segment eight; it is black in color and is much better developed than that of the larva. The last segment bears a pair of fleshy appendages. The chitinous plates of one side of the first and third to seventh abdominal segments are shown in pl. 16, fig. 1.

The Larval Case.—The case of the larva, when mature, is 15–20 mm. long; its diameter is 4 mm. or more at the cephalic end, according to the kind of material used in its construction. In form it is cylindrical, slightly curved. The larvæ, during their active period before pupation, construct their cases largely of quartz sand, but usually have a greater or lesser number of bark chunks around this inner cylinder. Sometimes, however, these bark fragments are almost, or even entirely, lacking. In preparation for pupation the larvæ usually remove almost all of the plant fragments from their cases. They then congregate in numbers on some support, as a submerged stick or root. Before pupation takes place the two openings of the case are stopped with small grains of sand firmly cemented in place. Apparently there is no mesh left open. Pl. 15, fig. 11, represents a larval case of quartz sand and a few fragments of bark.

EXPLANATION OF PLATES.

PLATE XV.

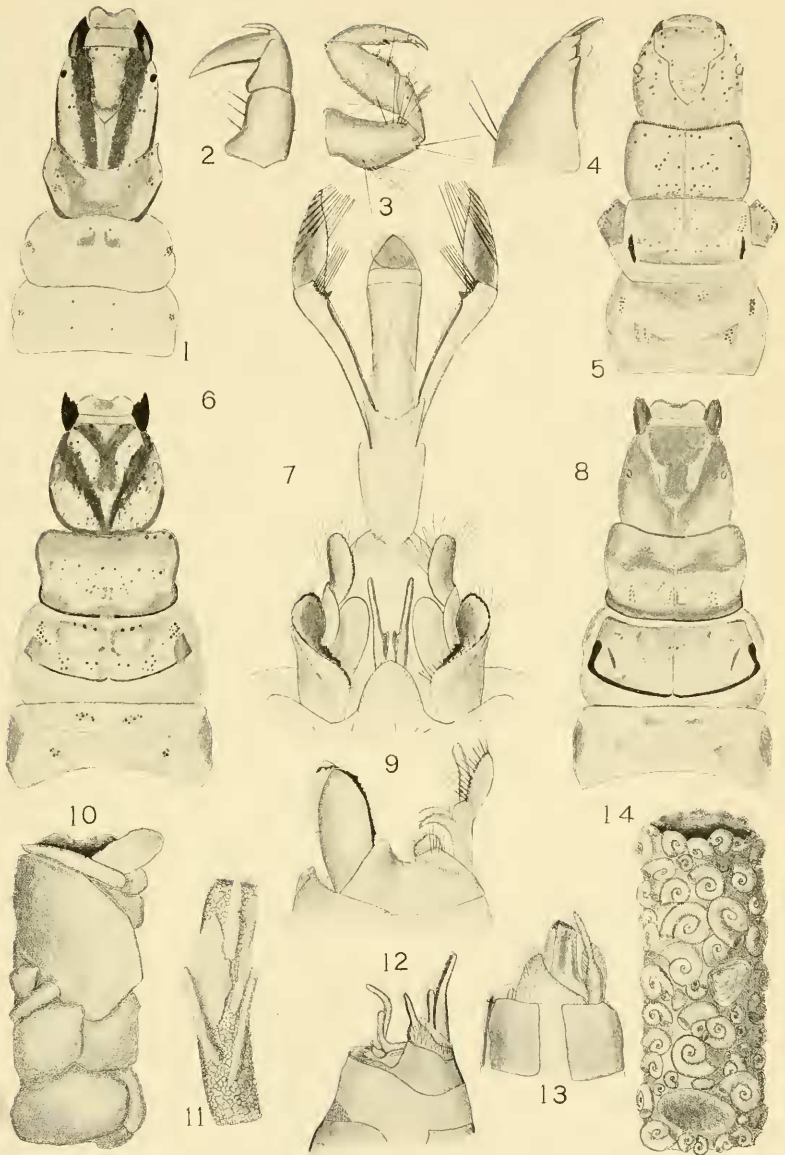
Neuronio pardalis Walk.

Larva.

Fig. 1. Dorsal view of head and thorax. Locations of principal setæ are indicated by black dots.

Fig. 2. Drag-hook.

Fig. 4. Mandible.



Trichoptera.

